

Fact Sheet

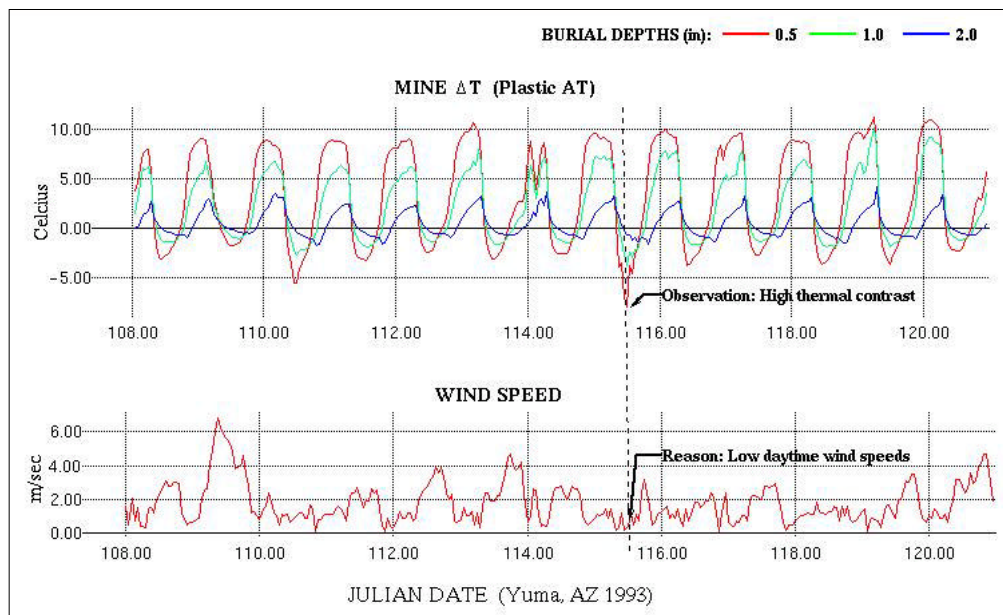
ENVIRONMENTAL INFLUENCES ON THERMAL SIGNATURES OF BURIED LAND MINES

PROBLEM

Thermal infrared (IR) imaging is one of the technologies being explored for use in multisensor systems for detecting buried land mines. The IR signals or signatures associated with buried mines are determined solely by environmental factors such as location, soil type, soil moisture, slope, weather conditions, and vegetation. It is important to develop both an understanding of environmental effects on mine IR signatures and an ability to quantify those effects and their resulting impact on mine detection system performance.

SOLUTION

An effort is underway at CRREL to develop a mine detection operational planning tool to predict the likelihood of successfully detecting buried mines using IR imaging equipment. This effort is focused on addressing those aspects of the mine detection problem that determine the mine IR signature at the ground surface: namely, the energy exchanges taking place within the soil, between the mine and soil, and between the soil and atmosphere. In the approach being used, an IR signature is represented as a predicted thermal contrast (i.e., temperature difference) between the ground surface directly above a mine and the ground surface away from the mine. This is accomplished using CRREL's Sntherm computer code. Sntherm is a one-dimensional mass and energy balance model for bare and snow-covered ground that has become a modeling standard for hydrological and climatic research. Ancillary code has been developed to adapt Sntherm to the mine detection problem and to permit batch solutions for different mine categories, soil conditions, and burial depths. The figure shows sample output for simulated plastic antitank mines buried at different depths in sand for a desert springtime scenario.



Additional improvements are being made to the Sntherm code and infrared measurements are planned to evaluate model signature predictions. Model output will be combined with the anticipated effects of other factors (such as the presence of vegetation) and converted within the final planning tool to a simple "Low-Medium-High" format for defining the potential for successfully detecting mines. When used in conjunction with forecast weather information, the tool will assist in the planning of mine detection operations.

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